The Maryland Public Drainage Task Force

RIVER CORRIDOR MANAGEMENT BIBLIOGRAPHY

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Introduction

This bibliography has been compiled by the Watershed Restoration Division and Maryland Geological Survey of the Maryland Department of Natural Resources for use by the Maryland Public Drainage Task Force. References on the subjects of agricultural drainage, river engineering and management, riparian corridor management, water quality, plants, and wildlife are included in the compilation. The referenced documents include government guidance documents, scientific papers and reports, and text books. Many of the referenced documents have been annotated to provide a brief summary of the content or findings of the document. Where possible, internet links have been provided. The purpose of this compilation is to provide background information that can help guide the Task Force members, natural resource managers, and the agricultural community to the literature that is available on a broad spectrum of topics related to river corridor management.

I Channel Hydraulics and Engineering

1. Andrews, B. 1993. **Roughness of vegetated and compound channels, a review**. Prepared by Philip Williams and Associates, Ltd. for the Alameda County Department of Public Works.

2. Gordon, N.D., T.A. McMahon, and B. Finlayson. 1992. **Stream Hydrology: An Introduction for Ecologists**. John Wiley and Sons. New York, New York.

3. Keller, E.A. 1976. **Channelization: environmental, geomorphic, and engineering aspects**. In: Environmental Geology. John Wiley & Sons, Ltd.. New York, New York.

4. Osman, O.M. and C.R. Thorne. 1988. **Riverbank stability analysis**. Journal of Hydraulic Engineering, Vol. 114, pp. 134-150.

5. United States Department of Agriculture, 1977. **Design of open channels**. Technical Release No. 25. U.S.D.A. Soil Conservation Service, Engineering Division, Washington, D.C..

II Channelization

6. **Annotated Code of Maryland.** 1984**.** Article 25, Sections 52-121H. The Annotated Code on County Commissioners contains the existing legal guidelines for the establishment and rights of public drainage associations within the state of Maryland. This law includes a description of the organization, funding, maintenance, documentation requirements for public drainage associations.

7. Grumbles, B. H. 1991. **Section 404(f) of the Clean Water Act: trench warfare over maintenance of agricultural drainage ditches**. William Mitchell Law Review; Vol. 17. No. 4. Summary: This paper discusses two clauses of Section 404 (f) of the Clean Water Act that serve as guidelines for land owners seeking exemption from filing permits for drainage ditch maintenance. The author highlights the restrictions on permit exemptions that create controversy between environmental, agricultural, and private property rights advocates. Following a summary of the provisions of Section 404 (f), related regulation and possible implications on land owners are discussed. The related documents discussed include: Regulatory Guidance Letter 87-7, the U.S. Army Corps of Engineers' 51/51 guideline, Section 307, and two Minnesota lawsuits concerning ditch maintenance. The analysis of these legal trends points out a concern that exemption rights may be lost in the future if the regulatory agencies do reform the current restrictions to permit exemptions.

8. Krohn, Tim. 1999. **The great debate: drainage systems**. Land and Water. March/April 1999, pp. 36-39. Summary: The floods of 1993 and 1997 along the Minnesota River Basin have sparked controversy over the current agricultural drainage practices. Related issues are summarized in this paper. Several studies on drainage issues related to flooding suggest that field tile can reduce the flooding impacts. Standing water in wetlands may prohibit the absorption of flood waters. Alternatively, some contend that drainage upstream causes flooding further downstream. Lawsuits against drainage proposals have been filed and new methods of managing drainage systems are being developed. Some ideas presented to control drainage include: installing holding ponds or wetlands to store water, filter water before it reached tiles, and implementing controlled drainage where some tile drains can be shut off to allow others to drain first. According to the author, a solution can be reached, but requires an adjustment of attitudes and an examination of the scope of the drainage problem (including urban runoff). The article includes a side

table of a 1989 study in Louisiana that shows the difference in chemical runoff between drained plots of land and undrained plots.

9. van Vuuren, W. and P. Roy. 1992. **Wetland preservation or drainage for agricultural development**. Paper presented at the "1992 International Winter Meeting sponsored by the American Society of Agricultural Engineers," December 15-18, 1992, Nashville, Tennessee. December 1992. Summary: A case study on Lake St. Clair in Ontario, Canada examines the costs and benefits to a landowner and to the public of either preserving wetlands or converting them to agricultural use. In the study, there was a discrepancy regarding the marsh size, diked and un-diked marshes, and the related social and private benefits. The analysis found that net preservation benefits exceeded net agricultural benefits; however, net agricultural benefits exceeded net preservation benefits from the land owner's point of view. This discrepancy was mainly due to the inability of the land owner to charge for many of society's benefits. Through this valuation, preservation of the wetland is the best land use for society while conversion to crop land is the best use of land to the owner. The authors contend that the conflict can be resolved with policy intervention. For example, drainage subsidies and property taxes currently influence the best use decisions of land owners. The public's willingness to pay is dependent on their awareness of benefits.

III Economic Considerations

10. Chesapeake Bay Program. 1998. **Economic benefits of riparian forest buffers**. Order from: U.S. EPA Chesapeake Bay Program. 410 Severn Ave. Suite 109. Annapolis, MD. 1-800-968-7229

11. Klapproth, J.C. 1998. **Selected bibliography of alternative income opportunities in riparian areas**. University of Maryland Cooperative Extension. Wye Research & Education Center, Queenstown, MD 21658.

12. Koehn, S. 1997. **Riparian forest buffer establishment programs**. Maryland Department of Natural Resources Forest Service. Streambank Stabilization

13. Lynch, L. and C. Brown. 1999. **Landowner decision-making about streamside buffers**. University of Maryland Department of Agricultural and Resource Economics. Policy Analysis Report 99-04. College Park, MD.

14. Lynch, L. **Economics of riparian buffers**. (In review). Maryland Cooperative Extension Fact Sheet. College Park, MD. pages.

15. Norton, G.A. and J.A. MacMillan. 1970. **Drainage maintenance and reconstruction costs and benefits: a watershed analysis**. Canadian Journal of Agricultural Economics, Vol. 18, No. 3, pp. 56-63. Summary: This paper provided an analysis of the benefits from Federal, municipal, and grower investments in drainage in Manitoba, Canada. The study used 1959-1969 data. The study used simple OLS to look at important variables that determine value of local drainage investment. For the cases investigated, municipal drainage and farm size were found to be the greatest determinants of value for investing in local drainage.

16. Palmquist, R.B. and L. E. Danielson. 1989. **A hedonic study of the effects of erosion control and drainage on farmland values**. American Journal of Agricultural Economics, Vol. 71, No. 1, pp. 55-62. Summary: This paper demonstrates the use of a hedonic land value study to determine the value of erosion control and drainage using data from North Carolina. Land values can be significantly affected by both potential erosivity and drainage requirements. The estimates from the evaluation were compared with estimates derived from a variety of other types of studies. The evaluation of 252 North Carolina land parcels sold in 1979-1980 found that farms with drainage valued 34% ($400 - $500) per acre more than non-drained using the specified criteria. Soils characterized by good and poor drainage were included in the study areas. In poorly drained areas, both drained and non-drained conditions were represented. The cost to put in drainage ranged between $80 - $400 per acre, depending on site and other existing drainage infrastructure. A hedonic model was used to derive these prices.

17. Pavelis, G. A. (no date). **Economic survey of farm drainage**. Summary: This survey gives the density of drained land in the United States, the number of known drainage enterprises, and information provided by the Bureau of the Census, Census of Drainage Organizations. The survey provides an estimate of land drained in the U.S. from 1855 to 1985. The estimate of land drained between these dates is determined by tallying the area where drainage improvements have been installed at least once, the amount of land drained (determined by the Bureau of the Census), and considering the service life and condition of farm drains. The presence of wet soils was also considered in predicting land likely to be drained. There have been two major trends noticed in this survey since 1960. First, individual farmers are controlling more of the drainage than drainage organization. Second, subsurface drainage is increasingly used over open ditch drainage. The investment in drainage includes the additional land put into agricultural use, the equipment needed to facilitate drainage, and the cost of constructing and maintaining collection and disposal structures. The economic cost of drainage is justified if installation cost is less than the expected benefit and if crop yield benefits exceeds operation and maintenance expenses. The costs of specific methods of drainage are cited and the historic trends in drainage investments are outlined in this paper. In 1985, the status of drainage was such that federal financial support was declining. Other trends are also described. In the humid east, land drainage affects production values and real estate values. The economic feasibility of drainage changes case by case, year by year. In the arid West, irrigation and drainage are considerations in the economic evaluation of land drained.

18. Skaggs, R. W. and A. Nassehzadeh-Tabrizi. 1983. **Optimum drainage for corn production**. Technical Bulletin. #274, North Carolina Agricultural Research Service, North Carolina State University, pp41. Summary: This investigation compared surface vs. subsurface drainage, as well as various spacings for subsurface drainage. Scenarios considered include corn grown on two soil types in North Carolina. Drainage was found to be profitable over a large range of options, with an optimum profit occurring with spacing of 25 to 40 m.

IV Floodplain Processes

19. Anderson, D.E., M.G. Walling, and P.D. Bates (eds). 1996. **Floodplain Processes**. John Wiley and Sons. New York, New York.

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21. Smith, S., P. Bereciartua, P. Johnson, J. Haltiner. 1999. **Channel design and the forgotten floodplain**. Water Resources Engineering Conference Proceedings. American Society of Civil Engineers.

V Geology

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VI Geomorphology

25. Abbe, Jr.., C. 1899. A general report on the physiography of Maryland. Maryland Weather Service , Vol. 1, pp. 41-216.

26. Baker, V.R. and R.C. Kochel, and P.C. Patton (eds). 1988. **Flood Geomorphology**. John Wiley and Sons. New York, New York.

27. Denny, C.S. and J.P. Owens. 1979. **Sand dunes on the Central Delmarva Penninsula**, Maryland and Delaware. USGS Professional Paper 1067-C.

28. Dunne, T. and L.B. Leopold. 1978. **Water in Environmental Planning**. W.H. Freeman and Sons, Inc.. San Francisco, CA.

29. Hupp, C. R. 1992. **Riparian vegetation recovery patterns following stream channelization: a geomorphic perspective**. Ecology, Vol. 73, No. 4. August 1992. Summary: The study considered six stages of channel evolution involved in stream adjustment. The author postulated that the type of vegetation present along the channel corresponded to the stage of adjustment of a particular channel. The geomorphology of a channel is characterized by the presence or absence of specific species, the stem density of the vegetation, and the average life span of the species present. The analysis of these dendro-geomorphic trends found that: 1) Patterns of woody vegetation recovery along modified alluvial channels develop in response to - and - affect patterns of fluvial geomorphic recovery following human-induced rejuvenation. 2) Bank widening, through mass wasting, and bank accretion are two important geomorphic processes that limit and affect woody vegetation patterns through the course of geomorphic recovery from channelization. This fluvial geomorphic recovery can be described in a six-stage model of bank evolution that depicts landscape development over time.

30. Keller, E.A. 1978. **Pools, riffles, and channelization**. Environmental Geology, Vol. 2, No. 2, pp. 119-127.

31. Keller, E.A. and F.J. Swanson. 1979. **Effects of large organic matter on channel form and fluvial processes**. Earth Surface Processes, Vol. 4, pp. 361-380.

32. Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. **Fluvial Processes in Geomorphology**. Dover Publishing, Inc. New York, New York.

33. Prestegaard, K.L., S. Dusterhoff, E. Stoner, K. Houghton, and K. Folk. 1999. **A preliminary assessment of the hydrologic and geomorphic characteristics of Piedmont and Coastal Plain streams (draft)**. Department of Geology, University of Maryland. Prepared for the Wetlands and Waterways Program, Maryland Department of the Environment.

34. Simon, A. and C.R. Hupp. 1992. **Geomorphic and vegetative recovery processes along modified stream channels of West Tennessee**. USGS Report 91-502.

35. Watershed Restoration Division. 2000. **Streams of Maryland, take a closer look**. Chesapeake and Coastal Watershed Service, Maryland Department of Natural Resources.

VII Hydrology

36. Dillow, J.A. 1996. **Techniques for estimating magnitude and frequency of peak flows in Maryland**. USGS Water-Resources Investigations, Report 95-4154.

37. Dunn, S.M. and R. Mackay. 1996. **Modeling the hydrological impacts of open ditch drainage**. Journal of hydrology; Vol.179, No.1/4, pp. 37-66. Summary: There are several variables involved in modeling drainage at the catchment scale, which makes hydrologic processes difficult to predict. Using a simple model to identify processes on a smaller scale is usually more manageable. Findings for small scale systems can be collectively examined to create a catchment scale prediction. In this study, open ditch drainage in a hill slope system in the U. K. was modeled to determine the hydrologic effects of the drainage. A physically-based hillslope model (SHETRAN) was used to model runoff volume, distribution between surface and subsurface flow, subsurface dynamics, flow duration curve statistics, and peak flow. The data used considered meteorological conditions, soil type, and vegetation. The model compared drained land to undrained land for three levels of drainage (natural, agricultural, and forested) in six different slope environments. Direct surface runoff was a significantly larger percentage of total runoff for undrained land (81%) than for drained land (53%). Undrained land exhibited little variation in subsurface run-off throughout the year in comparison to the drained land, which exhibited seasonal variation. Flow duration curves estimated the frequencies that the ditches changed the flow. Ditches were found to have negligible effects on runoff in dry conditions. The main effects of ditches was to increase the percentage of subsurface flow entering the channel as runoff and to increase the speed of surface runoff. The results of fine resolution simulations were parameterized and tested in a catchment scale

model of the South Tyne at Alston in U.K.. Parameters could be calculated for ditch density and geometry slopes within the catchment. This parameterization can only be used to model flow, not chemical transport. The results have not been validated for this study.

38. Hathoot, H. M.. 1984. **Total losses from trapezoidal open channels**. **ICID bulletin - International Commission on Irrigation and Drainage.** Vol.33,No.2. July 1984, pp. 81-84. Summary: The author has developed formulas to calculate total losses from trapezoidal open channels. Formulas measure seepage losses, evaporation losses, channel length, soil hydraulic conductivity, and effect of evaporation on channel length. In this report, the formulas are introduced with mathematical explanation, numerical example, and graphical representation.

39. Hunt, P. G., F.J. Humenik, and M.G. Cook. 1995. **Nitrogen and phosphorous in North Carolina Coastal Plain streams.** Clean water, clean environment, 21st century: team agriculture, working to protect water resources: conference proceedings, March 5-8, 1995, Kansas City, Missouri; Vol. 3., pp. 145-148. Summary: The U. S. Department of Agriculture Water Quality Demonstration Project in Herrings Marsh Run watershed in Duplin County, North Carolina included a two-phase sampling project to collect empirical data on the effect of agricultural best management practices on water quality. The first phase of the project was to assess the effect of traditional agriculture practices on the watershed. The second phase was to evaluate the effect of alternative management and landscape alteration on water quality. The results report on the nitrogen and phosphorous content of the water at each of the sampling sites, as well as the effects of an expanded lagoon and a created wetland on water quality. According to the authors, the notoriety of the results of the study have led to increased preservation of natural wetlands in North Carolina.

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42. Wahl, K.L., W.O. Thomas, R.M. Hirsch. 1995. **Stream-gaging program of the USGS**. USGS Circular 1123.

VIII NRCS Riparian Buffer Conservation Practice Standards

43. Maryland Natural Resources Conservation Service. 1999. **Conservation Reserve Enhancement Program**. USDA Natural Resources Conservation Service. 339 Busch's Frontage Road, Suite 301, Annapolis, MD 21401. http://www.md.nrcs.usda.gov/mdcrep.htm.

44. Natural Resources Conservation Service. 1997. **USDA Natural Resources Conservation Practice Standard Riparian Forest Buffer**. USDA Natural Resources Conservation Service. ftp://ftp.ftw.nrcs.usda.gov/pub/nhcp/pdf/391a.pdf.

45. Natural Resources Conservation Service. 1998. **Natural Resources Conservation Service Conservation Practice Standard: Riparian Herbaceous Cover**. USDA Natural Resources Conservation Service. Conservation Practice Standard 390. 3 pages. ftp://ftp.ftw.nrcs.usda.gov/pub/nhcp/pdf/390.pdf.

IX Riparian Zones

46. Alliance for the Chesapeake Bay. 1996. **Riparian forest buffers**. Alliance for the Chesapeake Bay White Paper. 16 pages. http://www.acb-online.org/forest.htm

47. Brown, T.C. and **Landscape aesthetics of riparian environments: relationship of flow quantity to scenic quality along a wild and scenic river** T.C. Daniel. 1991. . Water Resources Research, Vol. 27, No. 8.

48. Chesapeake Bay Riparian Forest Buffer Panel. 1996. **Final report of the riparian forest buffer panel**. U.S. EPA Chesapeake Bay Program. CBP/TRS 158/96. EPA 903-R-96-015. 8 pages. *Can be ordered from: US EPA Chesapeake Bay Program Office, 410 Severn Ave. Suite 109, Annapolis, MD 21403, phone 1-800-968-7229* or on-line at:www.chesapeakebay.net/pubs/155.pdf.

49. Chesapeake Bay Program Forestry Workgroup. 1997. **Restoring a Bay resource: riparian forest buffer demonstration sites**. U.S. EPA Chesapeake Bay Program CBP/TRS 159/97 EPA 903-R-97-001. 48 pages. Can be ordered from: US EPA Chesapeake Bay Program Office, 410 Severn Ave. Suite 109, Annapolis, MD 21403, phone 1-800-968-7229 or on-line at: www.chesapeakebay.net/pubs/324.pdf.

50. Chesapeake Bay Program Office. 1997. **Riparian forest buffers in the Chesapeake Bay watershed**. U.S. EPA Chesapeake Bay Program Fact Sheet CBP/TRS 163/97. EPA 903-F-97-002. Annapolis, MD. 4 pages.

51. Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. **Ecosystem perspective of riparian zones: focus on links between land and water**. Bioscience; Vol. 41, No. 8.

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53. McCall, J. D. and R.F. Knox. 1979. **Riparian habitat in channelization projects**. General technical report WO - U.S. Department of Agriculture, Forest Service; Vol. 12. 1979, pp. 125-128. Summary: The Indiana Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Soil Conservation Service (now the Natural Resources Conservation Service) entered into a joint effort in 1973 to mitigate biological losses resulting from the installation of county court ditches on agricultural land. Five projects were undertaken to reduce the impact of channelization on riparian habitat, fish, and wildlife. The project sites utilized the following strategies to minimize habitat damage and adverse impacts on riparian and aquatic lifej: In Prairie Creek in Vigo County, one side of a channel was preserved as a wooded swamp. In the middle fork of Anderson River in Perry County, the channel was able to remain wooded. Obstructions were cleared using hand tools and small machinery. In Rock Creek in Cass County, pools and riffles were constructed to increase fish habitat. In Rock Creek in Wells County, maintenance was conducted on one side of the channel, banks were stabilized by rocks, and spoils were planted with woody vegetation. In Buck Creek in Henry County, cattle were fenced out of the stream, one side of riparian trees were left uncut, and the other side was planted with a grass/legume mix. Rock deflectors were used to create pools for fish. The review concluded that these types of practices have advantages related to erosion control and the prevention of obstructions in the channel. In addition, the approach to mitigation emphasizes the need for biological review at proposed channelization sites.

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55. Quade, H. W. 1979. **County drainage ditches in South Central Minnesota: a unique riparian ecosystem**. General technical report WO - U.S. Department of Agriculture, Forest Service; 12. pp. 400-410. Summary: This report addresses drainage ditches as an ecosystem. The maps, charts, and text quantify the extent of ditching and reasons for artificial drainage in South Central Minnesota. This is followed by a discussion on the constitutionality of drainage including legal cases in Minnesota concerning drainage rights. Finally, a case study in Le Sueur County concluded that the ditch studied was not a major contributor of nutrients to the catchment lake. The author concludes the following: 1) further empirical evidence and documentation is necessary to facilitate careful planning in water resources management, 2) the construction and maintenance of ditches should be regulated by environmental guidelines, and 3) agricultural drainage and water quality may not be mutually exclusive in Minnesota.

56. Tjaden, R.L. and G.M. Weber. 1997. **Riparian forest buffer design, establishment, and maintenance**. Maryland Cooperative Extension Fact Sheet 725. College Park, MD. 8 pages. http://www.agnr.umd.edu/CES/Pubs/PDF/FS725.pdf.

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58. Tjaden, R.L. and G.M. Weber. 1997. **Riparian buffer systems**. Maryland Cooperative Extension Fact Sheet 733. College Park, MD. 2 pages. http://www.agnr.umd.edu/CES/Pubs/PDF/FS733.pdf.

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X River Corridor Restoration and Management

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62. Brooks, A. and F.D. Shields, Jr.. 1996. **River Channel Restoration: Guiding Principles for Sustainable Projects**. John Wiley and Sons. Chichester, England.

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68. New York Department of Environmental Conservation. 1986. **Stream corridor management: a basic reference manual**. Division of Water, Bureau of Water Quality, State of New York.

69. Shields, F. D., Jr. and N.M. Aziz. 1992. **Knowledge-based system for environmental design of stream modifications**. Applied Engineering in Agriculture; Vol.8, No.4, pp. 553-562. Summary: Three main types of channel modification alternatives mentioned in this article include bank protection, channel straightening and enlargement, and levee construction. In order to integrate environmental features into channel alteration projects, a user-friendly, knwledge-based systems (KBS) can be applied on a case by case basis. Environmental Design of Waterways(ENDOW) is one such knowledge-based system. ENDOW is a computer model that has been developed and reviewed to aid in the design of streambank protection structures, flood control channels, and streamside levees. It is designed to be a simple, quick method of evaluating environmental goals and engineering and institutional constraints. The user is asked

a series of multiple choice, true-false, and numeric input questions, which ENDOW tabulates and as a result recommends an environmental feature. This technology was expensive to develop. A survey was conducted of users of ENDOW to determine their satisfaction with the program.

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71. ______. 1994. **The impact of Federal programs on wetlands: a report to Congress by the Secretary of the Interior**. March 1994. Summary: The topography and hydrology of the Delmarva Peninsula (especially its wetlands) create an ecosystem that filters sediment, fertilizer , and chemicals; retains flood waters and reduces flooding downstream, serves as areas for discharge of ground water, and is food and habitat for wildlife and aquatic animals. This report discusses the history of agricultural drainage of Delmarva wetlands through a general pattern of construction and development. An outline is provided which assesses the implications of specific legislation and programs that mandate the control of wetland resources: a) Section 621 of the Coastal Zone Act Re-authorization Amendments of 1990; b) PL-566 technical assistance for wetland drainage consultation, mitigation, and review; c) Channel Modification Guidelines 1979; d) Conservation Options Program; e) Agricultural Conservation Program; f)Resources Conservation and Development Program; g)commodity programs; h)crop insurance programs promoting conversion to water impoundments. A synopsis of the status of current policy on wetlands is followed by recommendations from the US Secretary of the Interior about future wetland policy.

72. _______. 1985. **Wetland filters for agricultural drainage. Research Perspectives**. Vol. 4,No.2.,pp.12-13. Summary: Drainage for agriculture and forestry is possibly linked to increased peak runoff and the lowering of reproductive rates of aquatic organisms. Drainage has been linked to excess algae, lower dissolved oxygen, and silt deposition in the adjacent waterways. To address increasing concern about this connection, the governor of North Carolina appointed a Coastal Watershed Management Task Force. The Task Force recommended pumping agricultural drainage water through a swamp to remove sediment and nutrients. According to field studies in Dare and Tyrrell Counties, swamp filters remove 80 percent of the sediment and 75 percent of the phosphorous from agricultural drainage waters. Water quality, electrical conductivity, and pH were improved by the swamp filter. The team that conducted this research is developing ways to test the depth, speed, and duration of water flow in the swamp.

XI River Ecology

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Dolloff, C.A. and J.R. Webster. 1999. Particulate Organic Contributions from Forests and Streams: Debris Isn't So Bad. In: Verry, E.S., J.W. Hornbeck and C.A. Dolloff (eds.). Riparian Management in Forests of the Continental Eastern U.S. Lewis Publishers. Boca Raton, FL (800)272-7727.

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78. Perkey, A.W., K. Sykes, and R. Palone. 1993. **Crop tree management in riparian zones**. U.S. Forest Service. Northeastern Area State and Private Forestry. Morgantown, WV. http://www.fsl.wvnet.edu/frm/watershed/riparian.html

79. Klapproth, J.C. 1998. **Suppliers of plants and seed for forestry, wildlife, and streambank restoration projects**. University of Maryland Cooperative Extension Service. Wye Research & Education Center. Queenstown, MD. 4 pages. Also see: http ://Plant-Materials.nrcs.usda.gov:90/pmc/vendlink.html

80. Shankman, D. 1996. **Stream channelization and changing vegetation patterns in the U. S. Coastal Plain**. The Geographical Review, Vol.86, No. 2. April 1996. Summary: In western Tennessee and northwestern Mississippi, a history of agricultural ditching has changed the hydro-geomorphology of main rivers and their tributaries. This paper discusses some of the observed changes. These changes result in elimination of point bar surfaces, channel aggradation, and increased frequency of downstream flooding. As a result, the distribution of vegetation as it occurs on a naturally meandering stream has been disturbed.

81. Tjaden, R.L. and G.M. Weber. 1997. **Trees for riparian forest buffers**. Maryland Cooperative Extension Fact Sheet 726. College Park, MD. 4 pages. http://www.agnr.umd.edu/CES/Pubs/PDF/FS726.pdf.

82. Tjaden, R.L. and G.M. Weber. 1997. **Understory plants for riparian forest buffers and wildlife habitat improvement**. Maryland Cooperative Extension Fact Sheet 727. College Park, MD. 4 pages. http://www.agnr.umd.edu/CES/Pubs/PDF/FS727.pdf.

XIII Water Quality

83. Chambers, J. M., T.J. Wrigley, and A.J. McComb. 1993. **The potential use of wetlands to reduce phosphorus export from agricultural catchments**. Fertilizer Research, Vol.36, pp.157-164. Summary: Natural and artificial wetlands have been shown to remove nutrients from passing water. In the Peel-

Harvey catchment in Western Australia, three experiments were carried out to test the ability of wetlands to remove phosphorous from agricultural runoff. The first experiment measured the residence time for the removal of phosphorous from the wetland. The second experiment determined the effect of vegetation type and soil on a wetland's ability to take up nitrogen. The third experiment related flow rates through a wetland to phosphorous concentrations therein. The paper presented the following management options for using wetlands as phosphorous filters: 1) divert runoff through existing wetlands, 2) construct artificial wetlands at the outlet of major drain, 3) construct wetland filters and plant wetland vegetation along agricultural drains, 4) use artificial wetlands to filter point sources. The conclusion of this study call for preservation of existing wetlands and wetland vegetation along waterways. However, the study also found that artificial wetlands are limited in removing phosphorous in Australia

84. Clausen, J. C., D.W. Meals, and E.A. Cassell**.** 1992. **Estimation of lag time for water quality response to BMP's**. Proceedings: the national RCWP Symposium: 10 years of controlling agricultural non-point source pollution: the RWCP experience: September 13-17, 1992, Orlando, Florida. pp. 173- 179. Summary: Under the Rural Clean Water Program (RCWP), monitoring in the St. Alban's Bay watershed in Vermont determined no significant reduction in nutrient concentrations or mass exports. Two possible reasons for this outcome include: 1) the best management practices installed did not affect the water quality, 2) the lag time in between the installation of the best management practices and the cession of monitoring was not long enough to show results. A mathematical scheme that accounts for nutrient imports and exports may help in the selection of appropriate best management practices and in the estimation of the lag time for these management practices to effect water quality. A model has been developed for phosphorous and worked with an example. The model suggests the necessity to focus on improving water quality by managing field concentrations of nutrients.

85. Cochrane, H.H. and S.D. Williams. 1991. **Nutrient and sediment loads in a channelized stream and a non-channelized wetland stream in the Beaver Creek Watershed, West Tennessee**. Summary: A 1991 U.S. Geological Survey study in the Beaver Creek watershed in West Tennessee compared the sediment and nutrient loads of an unchannelized hardwood wetland basin, Baxter Bottom, to a channelized basin, Middle Beaver Creek. The land use of both basins was primarily row-cropping. Data samples were collected during storm events at one station from the outlet of each basin. Generally, the mean concentrations for suspended sediment and nutrients were higher at Middle Beaver Creek. Graphs and charts of the data show trends in nutrient and sediment levels at each station. Because the nutrient and sediment readings from the unchannelized wetland were less, the study suggests that natural streams and wetlands have the potential to reduce nonpoint source pollution.

86. Correll, D.L. 1997. **Buffer zones and water quality protection: general principles**. pp.7-20. In: Haycock, N.E., T.P. Burt, K.W.T. Goulding and G. Pinay (eds.). Buffer Zones: Their processes and potential in water protection. Proceedings of the International Conference on Buffer Zones, September 1996. ISBN 09530051 0 0. Quest Environmental. Harpenden, Herfordshire, UK. 322 pages. Can be ordered from: Foundation for Water Research. tel +44 1628 891589, or contact Quest Environmental: nehaycock@qest.demon.co.uk www.riparianbuffers.umd.edu/manuals/correll.html

87. Correll, D.L. 1999. **Vegetated stream riparian zones: their effects on stream nutrients, sediment, and toxic substances**. An annotated and indexed bibliography. Smithsonian Environmental Research Center. Edgewater, MD http://www.serc.si.edu/SERC_web_html/pub_ripzone.html

88. David, M. B., L. E. Gentry, D.A. Koviacic, and K.M. Smith. 1997. **Nitrogen balance in and export from an agricultural watershed.** Journal of Environmental Quality. July/August, pp. 1038-1048.

Summary: Studies show that tile drains contain high concentrations of nitrate (NO_3^-) in the water from agricultural land. In Illinois, where a large proportion of agricultural production is dependent upon the effective drainage of the land, tile drainage is common. In an effort to understand the relationship between tile drainage, current agricultural practices, and river nitrate concentrations, a study was performed in the Embarras River watershed (Camargo, Illinois) where tile drainage comprises 75 percent to 80 percent of the total land area and 70 percent of the watershed area is managed by tile drain districts. From 1991 through 1996, researchers measured nitrogen (nitrate, nitrite, and ammonia) and water flow rates in the Embarras River at three sites and four drainage tile outflows. From this data collection, the authors developed a nutrient budget for corn/soybean agricultural fields in the watershed. For maize, the most important sources of nitrogen ranked: 1) fertilizer, 2) soil mineralization, and 3) grain harvest. For soybean, the main source of nitrogen was soil mineralization. The average efficiency of nitrogen uptake for each crop was 48 percent for maize and 112 percent for soybean during the study. Soybean values may be overestimated). The study compares land use to the concentration of nitrogen in the river. By estimating the nitrogen budget of the soil in this agricultural watershed, the researchers found that there was a large amount of inorganic nitrogen in the soil originating from fertilizer application and soil mineralization. Of this inorganic nitrogen, an average of 49 percent nitrate was exported to the Embarras river via tile drains. High flow rates caused large exports of nitrogen in the drainage tiles into the river.

89. Donigian, A. S. and B.R. Bicknell, Jr. 1993. **Regional assessment of nutrient loadings from agriculture and resulting water quality in the Chesapeake Bay area**. Agricultural research to protect water quality: proceedings of the conference February 21-24, 1993 Minneapolis, Minnesota. February 1993, p 483-485. (Extended abstract). Summary: To facilitate the 1987 Chesapeake Bay Agreement of a 40 percent reduction in nutrient loadings in the Bay, the Chesapeake Bay Watershed Model was designed to quantify the needed reductions in nutrient imports to the estuary. The model is intended to allow for evaluation of the impacts of land use changes, alternative nutrient management, and alternative agricultural practices. The model is a combination of the U.S. Environmental Protection Agency Hydrologic Simulation Program-Fortran (HSPF) and AGCHEM, a soil nutrient model. The results of the simulation using the model showed that: 1) total nitrogen and total phosphorous were at expected levels for crop land and non-crop land, 2) conventional tillage was higher than conventional tillage in all nutrients except nitrate, and 3) total nitrogen and total phosphorous rates from highest to lowest were found in manure-fertilized fields, conventional tillage plots, conservation tillage plots, urban land, hay land, pasture, and forest. The Chesapeake Bay Watershed Model is currently being used by the EPA Chesapeake Bay Program Office.

90. Frarey, L. C. and H.H. Jones. 1996. **Watershed-based management strategies for the prevention and abatement of polluted agricultural runoff**. Environmental Monitoring and Assessment, Vol.41.,pp. 109-124. Summary: The Texas legislature's methods of handling runoff pollution from concentrated animal feed operations in Erath County provides an example of a watershed-based approach to agricultural pollution. In 1990, the Texas Legislature established the Texas Institute for Applied Environmental Research (TIAER)to address pollution from concentrated animal feed operations. TIAER set up a monitoring network in the Upper North Bosque River Watershed of Erath County and a constituency committee consisting of citizens, livestock producers, university researchers, administrative agency personnel, and chaired by a state senator. Recommendations from the constituency committee were incorporated into Senate Bill 503, passed by the Texas Legislature. The bill includes provisions for government financial assistance, a time frame for voluntary adoption of best management practices, and a low-cost, local system for handling complaints. To prioritize pollution problems and target high priority areas, the Texas governmental agencies utilize a micro-watershed approach.

91. Lichtenberg, E., B.V. Lessley, and H.D. Howar. 1991. **Maryland farmers' adoption of best management practices for nonpoint source pollution control**. Bulletin - Cooperative Extension Service, University of Maryland; Vol. 345. 1990/1991. Summary: The University of Maryland

Cooperative Extension Service conducted a survey of 208 farmers in the state to determine their views about best management practices in use on their land. The Cooperative Extension Service describes some current structural and managerial best management practices (BMP), and endorses government cost-sharing in the implementation of best management practices. Two hundred eighty farmers surveyed represented the four agricultural regions of the state: the Piedmont, the Upper Eastern Shore, the Lower Eastern Shore, and Southern Maryland. The data was used to assess demographics, perceptions of water quality, types of best management practices, regional differences in adoption, size and types differences in farms, temporal patterns, perceived effects of best management practices, the significance of cost-sharing, and information sources used. The survey highlighted responses related to water quality problems in Maryland and the link between agriculture and water quality. The survey results allowed for generalizations of Maryland farmer's perceptions about the effectiveness and economic value of best management practices. The authors suggested that negative incentives such as taxes or fines may be more effective in increasing the use of best management practices in the state by independent farmers. Also, they found that there is a need for more education outreach to the farmers about these alternative practices.

92. Lilly, J. P. 1991. **Best management practices for agricultural nutrients**. AG– North Carolina Agricultural Extension Service, North Carolina State University; 439-20. March 1991. Summary: Best management practices are defined by the author as methods to control nutrient loading and subsequent water quality degradation while maintaining crop growth. The best management practices discussed in the publication include soil testing and heeding soil test recommendations, setting realistic yield goals, choosing suitable nitrogen sources, applying nitrogen and phosphorous correctly, timing applications correctly, using manure, controlling erosion, managing water flow, and fencing animals away from waterways. The purpose of the publication is to give a general idea of best management practices that are suitable to land throughout North Carolina. Best management practices should be selected for an individual situation.

93. McCoy, J., N. Primrose, P. Sturm, S. Bowen, and C. Mazzulli. 1999. **Upper Pocomoke:: calibration of the agricultural BMP evaluation 1994-1998.** Chesapeake and Coastal Watershed Service, Maryland Department of Natural Resources.

94. Phillips, C. G. and H.G. Marshall. (no date). **Phytoplankton relationships to water quality in Lake Drummond and two drainage ditches in the Great Swamp, Virginia.** Summary: From December 1988 to November 1989, water quality and phytoplankton species were monitored in Lake Drummond and the Washington and Jericho ditches in Great Swamp, Virginia. The conditions in the ditches were compared to each other and to the Lake. The study found the dominant species of phytoplankton in the Lake to be *Asterionella formosa*. This evidence of increasing cyanobacteria abundance is often an indicator of increased nutrient loading and the lowering of pH. Seasonal changes effected nutrient levels and phytoplankton presence. The findings concluded that Lake Drummond is an early stage eutrophic lake.

95. Primrose, N.L., C.J. Millard, J.L. McCoy, M.G. Dobson, P.E. Sturm, S.E. Bowen, and R.J. Windschitl. 1997. **German Branch targeted watershed project: biotic and water quality monitoring evaluation report (1990-1995).** Chesapeake and Coastal Watershed Service, Maryland Department of Natural Resources.

96. Shedlock, R.J., J.M.Denver, M.A. Hayes, P.A. Hamilton, M.T. Koterba, L.J. Bachman, P.J. Phillips, and W. Banks. 1999. **Water quality assessment of the Delmarva Peninsula, Delaware, Maryland, and Virginia**: Results of Investigations, 1987-91. U.S.G.S. Water Supply Paper 2355-A.

97. Shirmohammadi, R. D., W.F. Weinberg, and W.F. Ritter, and F.S. Wright. 1995. **Effect of agricultural drainage on water quality in the mid-Atlantic states**. Journal of Irrigation and Drainage Engineering; Vol. 121, No. 4., pp.302. Summary: This paper considers the historical, legal and environmental aspects of drainage practices in this Mid-Atlantic region. The history of drainage practices in the mid-Atlantic states dates back to the 1700's and includes the implementation of the first organized drainage projects and the development of materials and installation methods. A discussion of four proposed drainage projects under Public Law 566 demonstrate the social and institutional constraints on the progress of drainage. Water quality changes are linked to increased drainage. Three studies are cited in which water table levels, nutrient and sediment monitoring, and modeling show a decline in water quality associated with increased drainage runoff. Educational programs, further research and monitoring, and integration of drainage into farming management practices are suggested methods to improving water quality effected by agricultural drainage runoff in the mid-Atlantic states.

98. Speiran, G.K., P.A. Hamilton, and M.D. Woodside. 1998. **Natural processes for managing nitrate in ground water discharged to Chesapeake Bay and other surface waters: more than forest buffers**. U.S. Geological Survey Fact Sheet FS-178-97. 5 pages. Order from: 3600 W. Broad St. Room 606, Richmond, VA 23230. 1-800-684-1592; For related information see http://www.usgs.govBay Journal. 1998. A Downhill Effort. Alliance for the Chesapeake Bay. Bay Journal. 6600 York Rd., Suite 100, Baltimore, MD. 21212.

99. Staver, K.W., and R.B. Brinsfield. 1996. **Seepage of groundwater nitrate from a riparian agro-ecosystem into the Wye River Estuary**. Estuaries. Vol. 19:359-370.

100. Stone, K. C., P.G. Hunt, J.M. Novak, and T.A. Matheny. 1994. **Impact of BMP's on stream and ground water quality in USDA demonstration watershed in the Eastern Coastal Plain**. Environmentally Sound Agriculture: Proceedings from the Second Conference: 20-22 April 1994. pp. 280-286. Summary: In 1990, a five-year study on water quality was initiated in the Cape Fear River Basin in Duplin County, North Carolina. Groundwater and surface water samples were taken throughout the Herrings Marsh Run watershed. Nitrogen and phosphorous were monitored and management practices noted. The study found that traditional agricultural practices had a negative effect on water quality at some locations, however the majority of the test sites had acceptable water quality.

XIV Wildlife

101. Klapproth, J.C. 1996. **The benefits of riparian forests**. Forest Landowner Vol 55, No. 6, pp. 28-31

102. Melchiors, M.A. 1996. **Birds and small mammals of stream-side management zones in Arkansas**. Paper presented at 1996 National Council for Air and Stream Improvement Southern Regional Meeting. Mobile, AL.

103. Melchiors, M.A. 1996. **Riparian zones and wildlife in managed forests**. Paper presented at Virginia TWS meeting.

104. Melchiors, M.A. 1996. **References related to birds and stream-side management zones - Eastern North America**. Presented at 1996 Virginia TWS meeting.

105. Wade, R. 1993. **Planting crops for wildlife**. Maryland Cooperative Extension Fact Sheet 598. College Park, MD. 7 pages. Order at: http://www.agnr.umd.edu/ces/pubs/order.html

106. Wigley, T.B. and M.A. Melchlors. 1994. **Wildlife habitat and communities in streamside management zones: a literature review for the Eastern U.S.** Pages 100-120. In: Riparian Ecosystems in the Humid U.S. Functions, Values, and Management. Proceedings of a Conference.